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Specification, as originally filed, with Application for Patent Serial No: **2,489,504**, on November 25, 2004, by **SPORT MASKA INC.**, assignee of Ray Blotteaux and Justin Roth, for "Bumper Shaft".

Agent certificateur/Certifying Officer

March 29, 2005
Date

Canada

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Bumper Material Selection

The primary function of the bumper is energy dissipation. The bumper acts to absorb and distribute the shock of an external impact in a direction perpendicular to the line of action of impact.

Cast or foamed elastomeric materials are best suited to this application, there are a variety of candidate materials and vendors to choose from:

Bumper Materials	Vendors
Thermoplastic Polyurethane	RTP, Dow, Bayer, 3M, BASF
Thermoset Polyurethane	Cytec, Innovative, DuPont, Bayer, Henkel, BJB Enterprises, GE, NuSil
Silicone Rubber	Dow Corning, Silicones Inc., Bayer
Polyisoprene (Natural Rubber)	Lavelle
Polybutadiene	Bayer
Polyisobutylene	PRC DeSoto
Latex	Dow, DuPont

All of these materials are classified as elastomers and good as dissipating energy from impact.

The range of hardness or Durometer of the bumper could be from 10 Shore A to 80 Shore D depending upon the desired balance between tactical feel and energy dissipation.

Injection Process and Tooling

There are a variety of different methods for attachment of the bumper onto the carbon fiber shaft, they include but are not limited to:

Injection Process	Tooling
Injection Molding - thermoplastic	CNC tool steel or aluminum
Injection Over Molding – thermoset	CNC tool steel or aluminum, cast elastomeric silicone
Pressure Molding	CNC tool steel or aluminum
Compression Molding	CNC tool steel or aluminum
Gravity Casting	CNC tool steel or aluminum
Vacuum Casting	CNC tool steel or aluminum
Secondary Bonding – this means to pre-cure the elastomeric bumper and then bond or glue the bumper in place on the shaft	Aluminum or steel alignment jigs and fixtures

Elastomers can be cured out from room temperature to elevated temperatures up to the limit of the glass transition temperature of the carbon fiber shaft (290 degrees F).

Over molding can be cast horizontally, vertically or with the tooling oriented at an angle. The injection can take place from either the top or the bottom of the shaft.

Extension of coverage to include the blade

A logical extension of the bumper patent is to include the blade. The external periphery (edge) of the blade could be protected with the addition of an elastomeric material. This elastomer would protect the blade not only from impacts with another shaft/blade, but also from contact with the ice.

Generalized Process Specification – Bumper Shaft Injection:

1. Install injection over molding tooling into injection press
2. Mold release the injection over molding tooling
3. Heat tooling to injection temperature
4. Wipe carbon fiber shafts with solvent to remove residual oils and contaminants.
5. Install shafts into injection over molding tooling
6. Apply compression/clamping pressure to shafts with press
7. Connect meter mix dispense equipment to injection port on injection over molding tooling
8. Discharge a metered shot of elastomer into tooling
9. Allow elastomer to cure
10. Demold over molded shafts
11. Clean tool
12. Mold release tool
13. Post cure shaft
14. Repeat

Based upon the current process development, the preferred embodiment should detail the following:

- Material – Family of Thermoset Polyurethane
- Durometer – 60-80 Shore A
- Process – Injection Over Molding
- Tooling – CNC Aluminum
- Cure Temperature – 100-180F depending upon cycle time or volume requirements